REMARKS

Present Status of the Application

The Office Action rejected claims 1-2, 4-6 and 38-40 under 35 U.S.C. 102(e), as being anticipated by Small et al. (U.S. 2002/0111026). The Office Action also rejected claims 7 and 41 under 35 U.S.C. 103(a) as being unpatentable over Small et al. (U.S. 2002/0111026) in view of Hirabayashi et al. (U.S. 5,575,885). The Office Action further rejected claims 1-2, 4-7, 25-30, 31-32 and 35-36 under 35 U.S.C. 103(a) as being unpatentable over Hirabayashi et al. (U.S. 5,575,885) in view of Hsu (U.S. 6,096,633). The Office Action rejected claims 33-34 and 37 under 35 U.S.C. 103(a), as being unpatentable over Hirabayashi et al. (U.S. 5,575,885) in view of Small et al. (U.S. 2002/0111026). Specifically, the Office Action also rejected claims 1-2, 4-7, 25-30 and 31-36 under the judicially created doctrine of obviousness-type double patenting over claims 1-8 of Hsu (U.S. 6,696,361). Applicants have amended claims 1, 31, 33-34 and 37-40 to improve clarity. After entry of the foregoing amendments, claims 1, 2, 4-7 and 31-41 remain pending in the present application, and reconsideration of those claims is respectfully requested.

Response To Double Patenting Rejection

In response to the double patenting rejection, Applicants submit herewith a terminal disclaimer pursuant to 37 C.F.R. §1.321(c). Applicants have submitted the terminal disclaimer solely to advance prosecution of the application, without conceding that the double patenting rejection is properly based. Applicants further declare that the present invention is a continuation

application of U.S. Patent 6,696,361. In filing the terminal disclaimer, Applicants rely upon the rulings of the Federal Circuit that the filing of such a terminal disclaimer does not act as an admission, acquiescence or estoppel on the merits of the obviousness issue. See, e.g., Quad Environmental Tech v. Union Sanitary Dist., 946 F.2d 870, 874-875 (Fed. Cir. 1991); and Ortho Pharmaceutical Corp. v. Smith, 959 F.2d 936, 941-942 (Fed. Cir. 1992).

Discussion of Office Action Rejections

The Office Action rejected claims 1-2, 4-6 and 38-40 under 35 U.S.C. 102(e), as being anticipated by Small et al. (U.S. 2002/0111026; hereafter Small) and asserted that Small discloses all claimed features of the present invention.

Applicants respectfully traverse the rejections for at least the reasons set forth below.

It is well established that anticipation under 35 U.S.C. 102 requires each and every elements of the rejected claims must be disclosed exactly by a single prior art reference.

The amended independent claim 1 is allowable for at least the reason that Small fails to teach or disclose each and every features of the amended independent claim 1. As stated above, claim 1 recites:

> Claim 1. A method of removing contaminants from a silicon wafer after a chemical-mechanical polishing operation, comprising:
>
> providing a silicon wafer having a layer thereon;
>
> performing a chemical-mechanical polishing process to remove a portion of the wafer; and

treating the silicon wafer using an aqueous solution of ozone and providing an inertial mechanical force **after the chemical-mechanical polishing process is performed,** wherein the inertial mechanical force is provided by a polishing pad.

(***Emphasis added***). Applicants submit that claim 1 patently defines over the cited arts for at least the reason that the cited art fails to disclose at least the features emphasized above.

More specifically, Small fails to teach or suggest that the aqueous solution of ozone is used in a cleaning process after the chemical-mechanical polishing process is performed. In Small's application, Small only stated that the aqueous solution of ozone can be used directly for CMP in which the aqueous solution of ozone is dispensed between a wafer surface and a polishing pad to affect planarization (as shown in paragraphs [0010] and [0033]). That is, in Small's point of view, aqueous solution of ozone is a slurry or a polishing assistant used during chemical-mechanical polishing process. Nevertheless, Small fails to teach or suggest that the aqueous solution of ozone can be used in the steps following the chemical-mechanical polishing process. On the other words, Small never consider to use the aqueous solution of ozone in the post-CMP steps for further cleaning the polished wafer.

Therefore, Small substantially fails to teach each and every feature of claim 1, and therefore, Small cannot possibly anticipate the claimed invention as claimed in the proposed independent claim 1 in this regard.

Claims 2, 4-6 and 38-40, which depend from claim 1, are also patentable over Small, at least because of their dependency from an allowable base claim.

The Office Action also rejected claims 7 and 41 under 35 U.S.C. 103(a) as being unpatentable over Small in view of Hirabayashi et al. (U.S. 5,575,885; hereafter Hirabayashi).

Since claims 7 and 41 are dependent claims which further define the invention recited in claim 1, Applicants respectfully assert that these claims also are in condition for allowance according to the same reasons as discussed above for the rejection 102. Thus, reconsideration and withdrawal of this rejection are respectively requested.

The Office Action further rejected claims 1-2, 4-7, 25-30, 31-32 and 35-36 under 35 U.S.C. 103(a) as being unpatentable over Hirabayashi in view of Hsu (U.S. 6,096,633; hereafter Hsu).

Applicants respectfully submit that Hirayabashi is view of Hsu is legally deficient to render claims 1 and 31 unpatentable. Also, Applicants respectfully traverse this rejection but have amended claims 1 and 31 to clearly define the method according to the invention. As amended, claims 1 and 31 recite:

> Claim 1. A method of removing contaminants from a silicon wafer after a chemical-mechanical polishing operation, comprising:
>
> providing a silicon wafer having a layer thereon;
>
> performing a chemical-mechanical polishing process to remove a portion of the wafer; and
>
> treating the silicon wafer using an aqueous solution of ozone and providing an inertial mechanical force after the chemical-mechanical polishing

process is performed, wherein **the inertial mechanical force is provided by a polishing pad.**

Claim 31. A method of forming a damascene structure, comprising:

providing a substrate;

forming a dielectric layer over the substrate;

patterning the dielectric layer to form an opening that exposes a portion of the substrate;

forming a metallic layer over the substrate so that the opening is completely filled;

performing chemical-mechanical polishing to remove a portion of the metallic layer; and

treating the substrate using an aqueous solution of ozone and providing an inertial mechanical force so that contaminants on a surface of the substrate are removed, **wherein the inertial mechanical force is provided by a polishing pad.**

(***Emphasis Added***) Applicants submit that the claims 1 and 31 patently define over the prior art of record, for at least the reason that the prior arts fail to disclose at least these elements emphasized above.

More specifically, Hirayabashi fails to teach or suggest the use of the inertial mechanical force to assist the cleaning procedure after the chemical-mechanical polishing process is

performed. Hirabayashi simply teaches dipping the substrate with the buried interconnecting layer into an aqueous dissolved ozone solution for 3 minutes, followed by dipping into a hydrofluoric acid solution (col. 15, lines 30-35). In response to the Office Action which stated that "dipping is hand pressure called inertial mechanical force", Applicants respectfully submit that the inertial mechanical force of the present invention in the cleaning process after the chemical-mechanical polishing process is performed is provided by a polishing pad in the cleaning station or the buffer CMP station. In the present invention, by using the inertial mechanical force of the polishing pad, the ozone molecules reacts with the contaminants on the wafer surface and the reacted particles are carried away by the solution. However, Hirabayashi fails to teach or suggest the aforementioned claimed feature of the present invention.

Further, although Hsu mentions the use of chemical-mechanical polishing or etch back process for polishing the metal layer, Hsu fails to teach or suggest the use of aqueous solution of ozone and the inertial mechanical force provided by the polishing pad for the cleaning purpose only. Hence, Applicants respectfully submit that the combination of Hirabayashi and Hsu still fails to teach or suggest every claimed feature of the present invention.

Hence, Applicants respectfully submit that Hirabayashi in view of Hsu fails to render claims 1 and 31 unpatentable. Claims 2, 4-7, 25-30, 32 and 35-36, which depend from claims 1 and 31 respectively, are also patentable over Hirabayashi in view of Hsu, at least because of their dependency from an allowable base claim. Applicants respectfully assert that these claims are in condition for allowance. Thus, reconsideration and withdrawal of this rejection are respectively requested.

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The Office Action rejected claims 33-34 and 37 under 35 U.S.C. 103(a), as being unpatentable over Hirabayashi in view of Small.

Since claims 33-34 and 37 are dependent claims which further define the invention recited in claim 31, Applicants respectfully assert that these claims also are in condition for allowance according to the same reasons as discussed above for the rejection 103. Thus, reconsideration and withdrawal of this rejection are respectively requested.

CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims 1, 2, 4-7 and 31-41 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted,
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